Watershed Work Plan

NEWMAN WATERSHED

Stanislaus County,

California

April 1976

WATERSHED WORK PLAN AGREEMENT

between the

Orestimba Resource Conservation District

and the

Newman Drainage District

(hereinafter referred to as the Sponsoring Local Organization)

State of California

and the

Soil Conservation Service
United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Newman Watershed, State of California, under the authority of the Watershed Protection and Flood Prevention Act (P.L.566, 83'd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Newman Watershed, State of California, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about ten years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost $71,000).

2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

	Sponsoring Local Organization (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	89.5	10.5	-0- 1/

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
All Structural Measures	50	50	498,000

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Engineering Costs (dollars)
All Structural Measures	0	100	60,000

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be $5,000 and $53,000 respectively.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

12. A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.

16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Orestimba Resource Conservation District By /s/ Earl Perez

P. O. Box 573, Patterson, CA 95363 Title Vice President

Date 4-2-76

The signing of this agreement was authorized by a resolution of the governing body of the Orestimba Resource Conservation District adopted at a meeting held on April 2, 1976.

/s/ Reta Rea Muller
Secretary, Local Organization

P.O. Box 573, Patterson, CA 95363
Address Zip Code

Date April 2, 1976

Newman Drainage District
c/o W. J. McInnis
P. O. Box 1129
Tracy, CA 95376

By /s/ William Cerutti

Title President

Date April 2, 1976

The signing of this agreement was authorized by a resolution of the governing body of the Newman Drainage District adopted at a meeting held on April 2, 1976

Ray Sherman
Secretary, Local Organization

1133 Hills Ferry Rd., Newman, CA 95360
Address Zip Code

Date April 2, 1976

Appropriate and careful consideration has been given to the environmental impact statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

/s/ G. H. Stone
State Conservationist

April 5, 1976
Date

WATERSHED WORK PLAN

NEWMAN WATERSHED

Stanislaus County, California

ADDENDUM

April 1976

CONTENTS

INTRODUCTION

This addendum is based on procedures established for application of the Water Resources Council's Principles and Standards to implementation studies in process.

The Newman Watershed Work Plan was developed using current (1974) construction costs and a discount rate of 6-7/8 percent. Part 1 of this addendum shows project costs and benefits based on a rate of 6-1/8 percent.

Part 2 shows the effects resulting from evaluation of the selected work plan alternative, displayed under separate accounts for National Economic Development, Environmental Quality, Regional Development and Social Well-Being.

Part 3 presents an abbreviated alternative plan developed to emphasize environmental quality.

DISCOUNT RATE COMPARISON

Newman Watershed Project, California

This addendum shows the project costs, benefits and benefit-cost ratio based on a 6-1/8 percent discount rate, current installation costs, and current normalized prices. Annual project costs, benefits, and benefit-cost ratio are as follows:

1.	Project costs are	$ 50,000
2.	Project benefits are	$ 202,300
3.	The project benefit-cost ratio is	4.0 to 1

With secondary benefits excluded, average annual benefits are $165,300, and the benefit-cost ratio is 3.3 to 1.

April 1976

SUMMARY OF EFFECTS ON NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

SELECTED ALTERNATIVE

Newman Watershed, California

BENEFICIAL EFFECTS		ADVERSE EFFECTS	
COMPONENTS	MEASURES OF EFFECTS 1/ (Dollars)	COMPONENTS	MEASURES OF EFFECTS 1/ (Dollars)
A. The value to users of increased outputs of goods and services		A. The value of resources required for plan	
1. Drainage	160,600	1. Drainage	
		Project Installation	45,000
		Project Administration	4,000
		OM&R	6,000
TOTAL BENEFICIAL EFFECTS	160,600	TOTAL ADVERSE EFFECTS	55,000
		NET BENEFICIAL EFFECTS	105,600

1/ Average annual.

April 1976

SUMMARY OF EFFECTS ON ENVIRONMENTAL QUALITY ACCOUNT
SELECTED ALTERNATIVE

Newman Watershed, California

BENEFICIAL AND ADVERSE EFFECTS

COMPONENTS	MEASURES OF EFFECTS
A. Areas of Natural Beauty.	1. The project output will make available funds and resources that can be used to enhance the physical appearance of 51 farms on 3,030 acres.
	2. A more pleasing appearance of the farmsteads will result from the reduction of house settling and basement cracking.
	3. An 0.9-mile-long channel will be constructed through an area now devoted to dryland pasture.
	4. There will be a temporary disruption of the tranquility of the rural atmosphere during construction of the project.
B. Quality Considerations of Water, Land, and Air Resources.	1. Pollution caused by poorly operating septic tanks will be reduced.
	2. The increase in choice, yield and quality of crops will restore the land to its former productivity.
	3. Excess salts, which degrade the land and upset the soil-plant-water relationships, will be removed from the soil.
	4. Approximately 8,000 tons of dissolved salts per year will be contributed to the San Joaquin River.

SUMMARY OF EFFECTS ON ENVIRONMENTAL QUALITY ACCOUNT
SELECTED ALTERNATIVE

Newman Watershed, California

COMPONENTS	MEASURES OF EFFECTS
C. Biological Resources and Selected Ecosystems	1. A favorable habitat for the rare giant garter snake along about 0.9 miles of open channel will be created.
	2. A suitable supply of water along about 0.9 miles of channel will provide habitat for warm-water fish.
	3. A favorable habitat for birds and small game will be provided by plantings of suitable plant species along the 0.9 miles of open channel.
	4. Breeding areas for mosquitos will be eliminated, thereby improving living conditions for man and animals.
	5. More intensive agriculture will be practiced, inducing a reduction in the quality of wildlife habitat on agricultural land.
D. Irreversible and Irretrievable Commitments	1. Approximately 11.5 acres of land now devoted to dryland pasture will be required for the open channel.
	2. Approximately 455 acre-feet of water will be used annually to dilute the drainage effluent. If master drainage facilities for the San Joaquin Valley become available, this water would no longer be required.

April 1976

SUMMARY OF EFFECTS ON REGIONAL DEVELOPMENT ACCOUNT
SELECTED ALTERNATIVE

Newman Watershed, California

BENEFICIAL EFFECTS

COMPONENTS	MEASURES OF EFFECTS	
INCOME: 1/	State of California	Rest of Nation
A. The value of increased output of goods and services to users residing within the region.	$ 160,600	-0-
B. The value of output to users residing in the region from external economies.		
1. Induced and stemming from.	37,000	-0-
TOTAL BENEFICIAL EFFECTS	$ 197,600	-0-

ADVERSE EFFECTS

COMPONENTS	MEASURES OF EFFECTS	
INCOME: 1/	State of California	Rest of Nation
A. The value of resources contributed from within the region to achieve the outputs.		
1. Drainage		
a. Project Installation	$ 22,500	$ 22,500
b. Project Administration	-0-	4,000
c. OM&R	6,000	-0-
TOTAL ADVERSE EFFECTS	$ 28,500	$ 26,500
NET BENEFICIAL EFFECTS	$ 169,100	$- 26,500

EMPLOYMENT

A. Increase in number and types of jobs.	
1. Permanent Employment.	
a. Project Employment.	17.2 man-years of employment -- each year. Permanent unskilled and semi-skilled jobs.
b. OM&R Employment.	0.3 man-years of employment -- annually. Permanent semi-skilled jobs.

EMPLOYMENT

A. Decrease in employment.	-0- -0-

April 1976

1/ Average Annual

SUMMARY OF EFFECTS ON REGIONAL DEVELOPMENT ACCOUNT SELECTED ALTERNATIVE (CONT.)

Newman Watershed, California

BENEFICIAL EFFECTS			ADVERSE EFFECTS		
COMPONENTS	MEASURES OF EFFECTS		COMPONENTS	MEASURES OF EFFECTS	
	State of California	Rest of Nation		State of California	Rest of Nation
EMPLOYMENT (Cont.)			EMPLOYMENT (Cont.)		
1. Permanent Employment. (Cont.)					
c. Employment induced by and stemming from project.	10.5 man-years of employment annually. Permanent semi-skilled jobs.	--			
Total Permanent employment.	28.0 man-years of employment annually. Permanent semi-skilled jobs.	--			
2. Employment for Construction.					
a. Employment for structural measure construction.	22.9 man-years of employment during 3-year construction period.	--			
b. Employment for land treatment construction.	140.6 man-years of employment during 10-year land treatment construction period.	--			
c. Employment induced by and stemming from construction activities.	257.6 man-years of employment during structural and land treatment construction.	--			
Total Employment for Construction	421.1 man-years of employment during construction of structures and land treatment. Semi-skilled jobs.	--			

SUMMARY OF EFFECTS ON REGIONAL DEVELOPMENT ACCOUNT SELECTED ALTERNATIVE (CONT.)

Newman Watershed, California

BENEFICIAL EFFECTS			ADVERSE EFFECTS		
COMPONENTS	MEASURES OF EFFECTS		COMPONENTS	MEASURES OF EFFECTS	
EMPLOYMENT (Cont.)	State of California	Rest of Nation	EMPLOYMENT (Cont.)	State of California	Rest of Nation
TOTAL BENEFICIAL EFFECTS	28.0 man-years of employment each year on continuing permanent basis.	--	TOTAL ADVERSE EFFECTS	-0-	-0-
	421.1 man-years of employment during construction of structural and land treatment measures.	--			
			NET BENEFICIAL EFFECTS	28.0 man-years of employment on continuing permanent continuing basis.	--
				421.1 man-years of employment during structural measures and land treatment construction.	--
ECONOMIC BASE AND STABILITY:	The project will lower the water table on 3,030 acres of land, allowing for more intensive land use and restoring the land to its former productivity. Create 17.5 man years of additional employment in the agricultural industry and 10.5 man-years of employment in the service and related industries each year. This will support a population of 98 persons; this will partially prevent emigration from the area.	--			

SUMMARY OF EFFECTS ON SOCIAL WELL-BEING ACCOUNT
SELECTED ALTERNATIVE

Newman Watershed, California

BENEFICIAL AND ADVERSE EFFECTS

COMPONENTS	MEASURES OF EFFECTS
A. Real Income Distribution	Creates 28 man-years of employment each year on a continuing basis. The agriculture sector will gain 17.5 man-years per year of employment. This will partially prevent emigration from the area as these jobs will support a total additional population of 61 in the area. The trade and service industries will gain 10.5 man-years per year of employment from the effects induced by and stemming from the project. The permanent jobs created will be in the unskilled and semi-skilled categories on the farms. The jobs created in the services and trades will be in the semi-skilled category.
B. Life, Health and Safety	Adequate drainage of the area will allow septic tanks to function properly, thus improving the health factors in the area. Breeding areas for mosquitos will be reduced thereby improving living conditions for man and animals.

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

An abbreviated alternative plan emphasizing environmental quality is shown in the flow chart on page 3-2. The chart illustrates the procedure used in developing the plan, and the content of the plan. The procedure begins with identification of the watershed problems. Specific needs and opportunities for meeting them were then listed. Plan elements were then selected to make use of the opportunities. A preliminary estimate of the installation cost was made, based on 1974 prices, and is shown on the chart. The expected environmental effects are also shown.

Although adequate legislative authorities exist, implementation of features of this alternative will require acceptance by the local people and the creation or designation of an entity to carry out the local responsibilities for installation and for operation and maintenance. Such an entity would also have to assume liability for the hazard posed by the man-made pool in the bottom of the channel.

ABBREVIATED ENVIRONMENTAL QUALITY PLAN
NEWMAN WATERSHED, CALIFORNIA

OBJECTIVE: Maintain and Enhance Environmental Quality

WATERSHED PROBLEMS	NEEDS	OPPORTUNITIES
Inadequate subsurface drainage of irrigated land.	Lower high water table on 5,000 acres.	Install subsurface drains on 5,000 acres. Install outlet facilities.
Over-irrigation of cropland.	Improve irrigation water management on 6,000 acres of cropland lying up-slope from the drainage problem area.	Encourage farmers to carry out irrigation water management and other land treatment practices through technical assistance program.
Inadequate treatment of cropland.	Improve farming operations on 5,200 acres of cropland.	
Low production on annual rangeland.	Improve management on 3,700 acres of annual rangeland.	Apply land treatment practices on 3,700 acres of rangeland.
Loss of wildlife habitat throughout region.	Make use of opportunities to develop wildlife habitat.	Include features to enhance habitat for warm-water fish, birds and small game in and along the drainage outlet channel. Locate the channel along Azevedo Road to provide public access to the fishery.
Increasing demand for fishing areas.	Develop additional fisheries.	
	Increase access to existing fisheries.	Provide public access along San Joaquin River.

PLAN ELEMENTS

ITEM	ESTIMATED INSTALLATION COST
Land treatment program on 8,900 acres of cropland, 50 acres of pasture and 3,700 acres of rangeland.	$ 3,830,000
16 miles of subsurface drains.	920,000
1.2 miles of new open channel and spoil bank, with ponding for fish habitat, wildlife habitat plantings, and 15 landscaped fishing access ramps; about 4 miles of public right-of-way along the San Joaquin River.	170,000
Estimated total installation cost:	$ 4,920,000

ENVIRONMENTAL EFFECTS

Areas of Natural Beauty

1. Improved appearance of 51 farms.
2. Diversity of appearance resulting from installation of 1.2 miles of open channel with landscaping.
3. Temporary disruption of tranquility of the rural atmosphere during construction.

Quality Considerations of Water, Land, and Air Resources

1. Reduction of pollution due to poorly operating septic tanks.
2. Removal of salts from the soil.
3. Increased productivity of 8,900 acres of cropland.
4. Improved maintenance of 3,700 acres of rangeland.
5. Improved access to San Joaquin River and its fishery.
6. Addition of about 13,000 tons per year of dissolved salts to the San Joaquin River.
7. Addition of about 6,500 acre-feet per year to flow in the San Joaquin River.
8. Increased traffic and allied effects resulting from public use of the fishery provided by the project.

Biological Resources and Selected Ecosystems

1. Provision of favorable habitat for warm-water fish, birds, small animals, and a rare snake species along about 1.2 miles of open channels.
2. Temporary disruption of feeding and nesting habitats of birds and small animals during construction.
3. Reduction of mosquito breeding areas.

Irreversible and Irretrievable Commitments

1. About 26 acres of land now in dryland pasture will be required for the 1.2 miles of new open channel.
2. About 750 acre-feet per year of water will be used to dilute drainage effluent.
3. An estimated 163.5 man-years of labor will be used during construction.

WATERSHED WORK PLAN

NEWMAN WATERSHED
Stanislaus County, California

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83'd Congress, 68 Stat. 666), as amended.

Prepared by: Orestimba Resource Conservation District

Newman Drainage District

With Assistance by:

U. S. Department of Agriculture, Soil Conservation Service

Resource Agency of California, Department of Conservation, Division of Resource Conservation

April 1976

TABLE OF CONTENTS

WATERSHED WORK PLAN

NEWMAN WATERSHED

Stanislaus County, California

December 1974

SUMMARY OF PLAN

The Newman Watershed occupies approximately 34 square miles and is located along the southern boundary of Stanislaus County, California, immediately west of the San Joaquin River. Within the watershed is a problem area of about 3,030 acres that suffers from a high water table. 1/ This high water table is the major water resource problem in the watershed. Its presence has resulted in a decline in agricultural productivity, damages to structures, and an increase in public health hazards.

The project is sponsored by the Orestimba Resource Conservation District and the Newman Drainage District. The boundaries of the latter District coincide roughly with the limits of the problem area. The sponsors propose to solve the high-water-table problem throughout the problem area by installing land treatment and structural measures to lower the water table to at least seven feet below the ground surface. Additional land treatment practices will then be applied to improve land and water management and return the area to its former level of productivity. Land treatment measures will also be applied throughout the remainder of the watershed.

Proposed land treatment measures for the problem area include about 164,000 lineal feet of subsurface drains, salt reduction on about 1,000 acres, and other conservation measures to improve farming operations on the 2,934 acres of cropland and pasture in the area. Measures to improve farming operations and water management will also be installed on cropland outside the problem area. Practices such as range seeding, proper grazing use, and fencing will be applied to rangeland in the upper watershed. Structural measures consist of about 10.5 miles of subsurface

---

1/ All information and data, except as otherwise noted, were collected during watershed planning investigation by the Soil Conservation Service, U.S. Department of Agriculture.

drain lines and 0.9 miles of channel, to collect and dispose of the effluent from the on-farm drains. The structural measures will be installed over a period of three years, and the land treatment measures over a period of ten years.

The project will lower the high water table throughout the problem area; improve the physical condition of the soil and the crop root environment; remove excess soluble salts from the soil; reduce health hazards caused by wet basements, poor septic tank operation, and mosquito population increases; reduce damage to structures; increase crop yields, employment opportunities and farm income; provide a reach of channel with water suitable for warm-water fish and suitable habitat for the giant garter snake, a rare reptile species; provide plantings which will offer wildlife cover and improved fire control; improve rangeland management; contribute about 8,000 tons of dissolved salts per year to the San Joaquin River; temporarily remove about 127 acres of land from production; create temporary disturbances from construction activities; induce increases in traffic, waste products, and energy consumption to support more intensive agriculture in the area; and lead to a reduction in the quality of wildlife habitat on farmland as a result of the intensified agriculture. The adverse impact of the additional salts in the river will be kept to a tolerable level by conformance to water quality standards being developed by the Central Valley Regional Water Quality Control Board.

Estimated installation costs are as follows:

	PL-566 Funds	Other Funds	TOTAL
Land Treatment Measures	$ 70,000	$3,360,000	$3,430,000
Structural Measures	362,000	325,000	687,000
TOTAL	$432,000	$3,685,000	$4,117,000

Land treatment measures will be installed and maintained by the individual landowners involved, with assistance and encouragement from the Orestimba Resource Conservation District. Additional technical assistance will be furnished by the Soil Conservation Service. Structural measures will be installed, operated, and maintained by the Newman Drainage District. The estimated average annual operation and maintenance cost for the structural measures is $6,000.

The estimated average annual cost of the structural measures is $55,000. Estimated average annual benefits are $197,600, yielding a benefit-cost ratio of 3.6 to 1.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Resources

The watershed is located midway along the southern boundary of Stanislaus County, California, and lies entirely within this county. The watershed occupies approximately 34 square miles and extends from the foothills of the Diablo Range on the west to the San Joaquin River on the east. The City of Newman is entirely within the watershed. The county seat is at Modesto, which has a population of about 62,000 and is located about 20 miles north of the watershed. Turlock, a city of about 14,000, is located about 15 miles northeast of Newman. The watershed has about 3,200 residents, including 2,500 in the City of Newman.

The watershed is in the San Joaquin Basin Subregion of the California-South Pacific Water Resource Region. This subregion is situated in central California. It extends generally from near Stockton on the north to near Fresno on the south, and from the crest of the Sierra Nevada on the east to the coast ranges on the west. The subregion is about 110 miles long and 95 miles wide and contains an area of about 11,000 square miles. The watershed is located on the lower slopes of the west side of the basin. Climate, soils, geology, topography, and land use in the watershed are typical of much of the subregion's west side.

Within the watershed is a problem area of about 3,030 acres that has a high, saline groundwater table. This area lies between State Highway 33 and the San Joaquin River. The Drainage District boundary on Figure 1 coincides roughly with the limits of the problem area. Similar areas are found at other locations along the west side of the San Joaquin Valley. 2/

The upper half of the watershed, west of the Delta-Mendota Canal, consists of moderately sloping mountainous rangeland. The cover is primarily grass with scattered oak trees. Most of this area is in land capability class VII. It is underlain by a series of dissected marine and continental sediments that are tilted toward the San Joaquin River and chiefly of Jurassic and Cretaceous age. The foothills formed by these older sediments are flanked on the valley side by a gently dipping coarse-grained formation of

---

2/ Miller, R.S., and C.E. Anderson, Progress Report, Factors Affecting Drainage on the West Side of the San Joaquin Valley, USDA, Soil Conservation Service, Berkeley, California, July, 1966.

Plio-Pleistocene age that dips beneath the valley floor to form the principal aquifer of the area. This unit, the Tulare formation, includes the Corcoran clay member, which is the aquiclude that separates the groundwater body of the San Joaquin Valley into confined and free zones.

The valley portion of the watershed, which includes the problem area, consists of alluvial fan deposits derived from the streams that flow northeasterly from the Diablo Range. These streams rarely reach the San Joaquin River as through flow, but spread out on the fan where they drop their sediment loads, with water infiltrating to groundwater. The area on which this process occurs can be considered a younger alluvial fan while the interstream area and the land to the northeast which no longer receive such deposits are older alluvial fans. Texturally, the surficial soils of the two fan areas are similar and include clay, silty clay, clay loam, and loam. However, below the surface, the younger fans are generally of lighter texture; sand and gravel are important constituents of these lower deposits. There are no known mineral deposits within the problem area.

The lack of pervious strata in the relatively shallow subsurface is apparently one of the key factors in the failure of the soils of the older fans to drain applied irrigation water rapidly. The boundaries of the problem area and the soils of the fans coincide in a general way.

Soils in the problem area are dominated by the Vernalis, Orestimba, and Salado Series. 3/ They are very deep loams and clay loams formed in recent alluvium from sedimentary rocks, on basin rims and alluvial fans. Slopes are mostly less than one percent. The problem area includes about 1,840 acres of Class II land and 1,190 acres of Class III land, with wetness being the principal restriction. Some areas also contain appreciable amounts of soluble salts and/or sodium salts. The soils are moderately or moderately slowly permeable. They have a high water holding capacity and can be very productive.

Elevations in the watershed range from about 45 feet above mean sea level at the San Joaquin River to about 1,130 feet in the foothills of the Diablo Range. Elevations in the problem area range from 45 to 90 feet. Average annual precipitation at Newman is about 10.5 inches, with most of this occuring between November and March. 4/ The minimum recorded temperature is 18 degrees F.

3/ Department of Plant Nutrition, University of California, Davis Soils of Westside Stanislaus Area, California, April, 1968.

4/ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climatological Data.

The average length of the growing season is 295 days.

Land use in the watershed is agricultural, except for roads, farmsteads, utility rights-of-way, the City of Newman, and a few small trailer parks located west of River Road, immediately north of Hills Ferry Road. The hills are in rangeland and the alluvial fans are in irrigated agriculture. A small area on the San Joaquin River flood plain is in native pasture. Within the problem area, about 459 acres are in pasture and the remainder is in field crops.

Present land use in the problem area and the entire watershed is as follows:

	Total Watershed		Problem Area	
Land Use	Acres	Percent	Acres	Percent
Cropland	12,540	58	2,475	82
Pasture	1,060	5	459	15
Rangeland	6,620	30	0	0
Other	1,530	7	96	3
TOTAL	21,750	100	3,030	100

There are about 75 acres of Type 9 wetlands (inland saline flats[5/]) in the watershed. This area is located between the problem area and River Road, north of Azevedo Road and the Azevedo Drain. It has become wetland within the last ten years and is fed by surface ditches whose flows are largely irrigation runoff. There are no waterfowl wetlands in the problem area.

A number of small ephemeral streams flow out of the foothills in the upper watershed. These carry flows from an area of about 13 square miles that lies west of the Delta-Mendota Canal. They have well-defined, natural channels within the foothills, but lose their identity as they cross the alluvial fan. The largest of these streams is Bennett Creek. Flows from Bennett Creek are intercepted by the Newman Wasteway of the Delta-Mendota Canal, which carries them to the San Joaquin River. None of the natural stream channels reach the problem area.

There are a number of small, man-made drains that are in the lower watershed or nearby. These include the Eastin Road, Freitas and Azevedo Drains, which are partly within the watershed, and the Anderson Road and Crow Creek Drains, located two to three miles north of the watershed.

5/ For classification system see U.S. Department of the Interior, Fish and Wildlife Service, Wetlands of the United States, Circular 39, Washington, D.C., reprinted 1971.

Plio-Pleistocene age that dips beneath the valley floor to form the principal aquifer of the area. This unit, the Tulare formation, includes the Corcoran clay member, which is the aquiclude that separates the groundwater body of the San Joaquin Valley into confined and free zones.

The valley portion of the watershed, which includes the problem area, consists of alluvial fan deposits derived from the streams that flow northeasterly from the Diablo Range. These streams rarely reach the San Joaquin River as through flow, but spread out on the fan where they drop their sediment loads, with water infiltrating to groundwater. The area on which this process occurs can be considered a younger alluvial fan while the interstream area and the land to the northeast which no longer receive such deposits are older alluvial fans. Texturally, the surficial soils of the two fan areas are similar and include clay, silty clay, clay loam, and loam. However, below the surface, the younger fans are generally of lighter texture; sand and gravel are important constituents of these lower deposits. There are no known mineral deposits within the problem area.

The lack of pervious strata in the relatively shallow subsurface is apparently one of the key factors in the failure of the soils of the older fans to drain applied irrigation water rapidly. The boundaries of the problem area and the soils of the fans coincide in a general way.

Soils in the problem area are dominated by the Vernalis, Orestimba, and Salado Series. 3/ They are very deep loams and clay loams formed in recent alluvium from sedimentary rocks, on basin rims and alluvial fans. Slopes are mostly less than one percent. The problem area includes about 1,840 acres of Class II land and 1,190 acres of Class III land, with wetness being the principal restriction. Some areas also contain appreciable amounts of soluble salts and/or sodium salts. The soils are moderately or moderately slowly permeable. They have a high water holding capacity and can be very productive.

Elevations in the watershed range from about 45 feet above mean sea level at the San Joaquin River to about 1,130 feet in the foothills of the Diablo Range. Elevations in the problem area range from 45 to 90 feet. Average annual precipitation at Newman is about 10.5 inches, with most of this occuring between November and March. 4/ The minimum recorded temperature is 18 degrees F.

3/ Department of Plant Nutrition, University of California, Davis Soils of Westside Stanislaus Area, California, April, 1968.

4/ U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Climatological Data.

The average length of the growing season is 295 days.

Land use in the watershed is agricultural, except for roads, farmsteads, utility rights-of-way, the City of Newman, and a few small trailer parks located west of River Road, immediately north of Hills Ferry Road. The hills are in rangeland and the alluvial fans are in irrigated agriculture. A small area on the San Joaquin River flood plain is in native pasture. Within the problem area, about 459 acres are in pasture and the remainder is in field crops.

Present land use in the problem area and the entire watershed is as follows:

	Total Watershed		Problem Area	
Land Use	Acres	Percent	Acres	Percent
Cropland	12,540	58	2,475	82
Pasture	1,060	5	459	15
Rangeland	6,620	30	0	0
Other	1,530	7	96	3
TOTAL	21,750	100	3,030	100

There are about 75 acres of Type 9 wetlands (inland saline flats[5/]) in the watershed. This area is located between the problem area and River Road, north of Azevedo Road and the Azevedo Drain. It has become wetland within the last ten years and is fed by surface ditches whose flows are largely irrigation runoff. There are no waterfowl wetlands in the problem area.

A number of small ephemeral streams flow out of the foothills in the upper watershed. These carry flows from an area of about 13 square miles that lies west of the Delta-Mendota Canal. They have well-defined, natural channels within the foothills, but lose their identity as they cross the alluvial fan. The largest of these streams is Bennett Creek. Flows from Bennett Creek are intercepted by the Newman Wasteway of the Delta-Mendota Canal, which carries them to the San Joaquin River. None of the natural stream channels reach the problem area.

There are a number of small, man-made drains that are in the lower watershed or nearby. These include the Eastin Road, Freitas and Azevedo Drains, which are partly within the watershed, and the Anderson Road and Crow Creek Drains, located two to three miles north of the watershed.

5/ For classification system see U.S. Department of the Interior, Fish and Wildlife Service, Wetlands of the United States, Circular 39, Washington, D.C., reprinted 1971.

The Freitas and Azevedo Drains are open ditches and the other three are piped. These drains carry local runoff and runoff from irrigation, their flows eventually reaching the San Joaquin River. Samples taken and analyzed by the Soil Conservation Service during project formulation showed typical quantities and qualities of surface drainage during the irrigation season to be as follows:

	Discharge (cubic feet per second)	Total Dissolved Solids (parts per million)
Eastin Road Drain	20	240
Crow Creek Drain	30	320
Freitas Drain	5	600
Azevedo Drain	2	700
Anderson Road Drain	17	300

Present and Projected Population

The watershed is located midway along the southern border of Stanislaus County. The Modesto Standard Metropolitan Statistical Area encompasses all of Stanislaus County. The population of the county in 1970 was 194,506. This is an increase of 24 percent since 1960. Over 80 percent of this increase was in the Modesto-Turlock Metropolitan Area. According to the projections made by the California Department of Finance, the population of the county will be approximately 314,000 by the year 2000. 6/ This represents a 61 percent increase for the next 30 years.

Economic Resources

All of the land within the problem area is privately owned except for the land in road and utility easements or rights-of way. There is no state or federal land in the watershed. Within the problem area are 51 ownerships. Five of these are about one acre each, another five are two to four acres, and six are four to twenty acres. These are too small to be considered family farms. Another five owners farm a total of 450 acres within the problem area and have large holdings elsewhere. The remaining thirty ownerships are family farms, with an average size of about 80 acres.

Alfalfa is grown on 42 percent of the problem area, pasture on 15 percent, other crops on 40 percent, and non-agricultural use occupies 3 percent. The yields of the crops in the problem area are below the county average, as is shown in the following table:

6/ Population Research Unit, Provisional Projections of California Counties to 2000, Report 74 P-1, Series D-100, Sacramento, California, January, 1974.

Crop	Yield, (tons per acre) Problem Area	County Average
Alfalfa	5.26	6.00
Corn	16.00	19.00
Green beans	1.00	1.35
Milo	1.00	2.88
Oats	1.00	2.10
Peas	1.00	2.00
Sugar beets	17.00	26.00
Tomatoes	18.00	25.00

Land values in the problem area reflect the shift from more intensive agriculture to extensive agriculture. The current land values within the problem area are greatly depressed compared to values of nearby lands without a high water table. Typical values are as follows:

Crop	Land Value in Problem Area	Land Value Outside Problem Area
Alfalfa or row crops	$900/ac	$1,500/ac
Irrigated pasture	$675/ac	$ 800/ac
Dryland pasture	$450/ac	$ 750/ac

Existing transportation facilities in the watershed provide ready accessibility to other areas. Interstate Highway 5, a major north-south artery, crosses the upper part of the watershed. State Highway 33 crosses the watershed about half a mile west of the problem area and the Southern Pacific Railroad parallels this highway. Hills Ferry Road is a well-developed, heavily-traveled east-west county road connecting the watershed to State Highway 99, formerly U.S. Highway 99, which is another major north-south artery and is located about 12 miles east of the watershed. Much of the produce grown in the watershed is processed in either Turlock or Modesto. Some produce is processed in other nearby towns such as Patterson, 12 miles to the north, or Gustine, 4 miles to the south. All of these cities are agriculturally oriented and are thus influenced by changes in the economy of the watershed.

The watershed is in an area which has a history of chronic and persistent unemployment, as defined by the Public Works and Economic Development Act of 1965. California Department of Human Resources data show the following average unemployment rates for

Stanislaus County:

Year	Rate (percent)	Year	Rate (percent)
1966	9.4	1970	10.6
1967	9.6	1971	11.1
1968	9.2	1972	9.8
1969	9.4	1973	10.5

Approximately 9.5 percent of the farms were classified as below the low-income level in 1969. 7/

Plant and Animal Resources

Approximately sixty percent of the watershed is in agricultural crops. All of the problem area is in crops or irrigated pasture. Other plants found in the agricultural areas include the following:

Trees	Ditch Bank Vegetation	Open Drain Vegetation
poplar	Johnsongrass	pondweeds
willow	wormwood	cattails
blue gum	creeping wildrye	tules
valley oak	tall fescue	
black walnut	bromegrasses	

Plants in the foothill area of the watershed are typical of much of the west side of the San Joaquin Valley. The same is true of the vegetation along the San Joaquin River. Some of the more common species are as follows:

Rangeland (Central Valley Grassland)	Grass-Oak Woodland	River Area
annual grasses	blue oak	annual grasses & forbs
soft chess	California buckeye	salt grass
red brome	sycamore	creeping wildrye
wild oats	digger pine	valley oak
forbs	chamise	black willow
filaree	toyon	cottonwood
turkey mullein	yerba santa	buttonwillow
tarweed	flat-topped buckwheat	cattail & tules
	annual grasses	water hyacinth

7/ U.S. Department of Commerce, Bureau of the Census, 1969 Census of Agriculture, May, 1972.

Fishery resources in the watershed are limited to the Delta-Mendota Canal, the California Aqueduct, the Central California Irrigation District Canal, the San Joaquin River, and one commercial "fish-out" operation located near the river. Anadromous fish, chiefly salmon and steelhead, are an important resource in the San Joaquin River. Historically, the anadromous fish run approached 300,000 fish annually, but upstream water development has reduced it to about 3,000 fish per year. The State Department of Fish and Game, in cooperation with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, is attempting to rebuild the salmon run to its former level. 8/

The San Joaquin River supports a warm-water fishery complex of black bass, bluegill, catfish, and carp. The Central California Irrigation District Canal seasonally supports a similar fishery but it is severly limited because the canal is de-watered during the winter months. The California Aqueduct and the Delta-Mendota Canal support a warm-water fishery consisting of catfish, striped bass, black bass, sunfish, and carp.

Other animals commonly found along the west side of the San Joaquin Valley are listed below:

Foothills	Agricultural Land	River Area
deer	yellow-billed magpie	mallard
quail	meadowlark	cinnamon teal
mourning dove	mourning dove	yellow-billed magpie
woodpecker	pheasant	red-tailed hawk
rabbit	skunk	sparrow hawk
ground squirrel	oppossum	white-tailed kite
coyote	ground squirrel	muskrat
bobcat	pocket gopher	weasel
mountain lion (occasionally)	gopher snake	
golden eagle		
red-tailed hawk		
rattlesnake		

Two rare species which may be found in this part of the San Joaquin Valley are the San Joaquin kit fox and the giant garter snake. The San Joaquin kit fox is generally restricted to areas of native vegetation supporting kangaroo rats, and is not found on agricultural land. The giant garter snake is confined to areas around permanent

---

8/ Letter from S. R. Galler, Deputy Assistant Secretary for Environmental Affairs, U.S. Department of Commerce, to T. C. Byerly, Office of the Secretary, USDA, June 26, 1972.

fresh water. 9/ The Kit Fox is listed as rare by the State Department of Fish and Game 9/ and as endangered by the U. S. Department of the Interior. 10/ No rare or endangered plant species are listed for this area.

Recreational Resources

The California Aqueduct crosses the upper watershed, and its right-of-way is open to fishermen and bicyclists. The City of Newman includes a city park. Fishing occurs along the canals in the vicinity and at the commercial "fish-out" establishment.

Archaeological, Historical, and Unique Scenic Resources

There are no presently known archaeological, historical, or unique scenic resources in the problem area. The National Register of Historic Places lists no such places west of the San Joaquin River in Stanislaus County. 11/

An archaeological survey was made along the alignments of the proposed structural measures: 12/ A copy of the report was furnished to the State Historic Preservation Officer. Information was also requested from the Stanislaus County Historical Society and the Anthropology Department of California State University at Turlock. The latter is the District Clearinghouse of the Society for California Archaeology. No evidence of any archaeological resources was found.

Soil, Water and Plant Management Status

On-farm land treatment practices are being carried on throughout the watershed as part of the conservation program of the Orestimba Resource Conservation District. An area which includes the problem area was annexed to the District in 1965. The current status of the District's program is shown by the following statistics:

	Problem Area	Watershed
Number of Cooperators	26	65
Number of Resource Conservation Plans	19	48
Percent of land covered by agreements	55	81

9/ California Department of Fish and Game, At the Crossroads, 1974, A report on California's Endangered and Rare Fish and Wildlife, Sacramento, California, January, 1974.

10/ Department of the Interior, "Endangered and Threatened Wildlife and Plants," Federal Register, Vol. 40, No. 188, Washington, D.C., 1975.

11/ Department of the Interior, "National Register of Historic Places," Federal Register, Vol. 41, No. 28, Washington, D.C., 1976.

12/ True, D. L., Department of Anthropology, University of California, Davis, Archaeological Surveys, Newman Creek Watershed, Stanislaus County, California, September 1975.

About 65 percent of the needed conservation practices are being applied on rangeland in the upper watershed. About 55 percent of the needed practices are being applied on cropland that lies between Interstate Highway 5 and State Highway 33.

The land in the problem area is currently used for agriculture, and this is expected to continue in the future. However, the high water table is causing a change from long-lived, high-yielding, salt-sensitive field crops to short-lived, low-yielding, salt-tolerant plants. The high water table has also hampered the installation of land treatment practices. The percentages of planned practices presently applied are as follows:

PRACTICE	PERCENT APPLIED
Chiseling and subsoiling	38
Conservation cropping system	67
Crop residue management	38
Irrigation pipeline	25
Irrigation water management	7
Irrigation land leveling	50
Irrigation system, surface and subsurface	25
Irrigation ditch and canal lining	14
Drainage field ditch	75
Subsurface drain	0
Salt reduction	0

Approximately 1,100 acres in the problem area are considered adequately treated except for the installation of on-farm subsurface drains and salt reduction. These practices cannot be effectively applied until an adequate outlet system becomes available.

WATER AND RELATED LAND RESOURCE PROBLEMS

The major water resource problem in the watershed is the high water table and associated accumulation of soluble salts in the soil in the problem area. A high water table first developed after the start of irrigation from the Miller and Lux Canal (now Central California Irrigation District), around 1917. The drilling of a large number of comparatively deep irrigation wells to the west arrested the rise of the subsurface water table and in some parts of the area reversed it. When the Delta-Mendota Canal was constructed in the early 1950's, a large area of higher land lying west of the problem area was brought under irrigation. In addition, Delta-Mendota water was used to replace water from many of the wells, and pumping from these wells ceased. This resulted in a resumption of the rise of the groundwater table. This rise became noticeable around 1958 and is continuing. The water table is currently within six feet of the surface over about 80 percent of the problem area, within four feet over about 60 percent, and within 2.5 feet over about 30 percent of the area.

The high water table limits the choice of crops, shortens longevity of perennial crops and reduces yields. The water table also fluctuates, which increases the problem. The deep-rooted crops which were formerly grown in the area, such as alfalfa, tomatoes, and sugar beets, are being replaced by lower-valued crops such as milo and pasture. If the water table is not lowered, the alfalfa acreage in the problem area is expected to decrease from 1,257 acres today to about 880 acres in ten years, irrigated pasture acreage is expected to increase from 459 acres today to about 800 acres in ten years, and milo and oat acreage is expected to increase from 483 acres today to about 910 acres in ten years.

The typical life span of alfalfa in nearby areas without a high water table is about six years. Within the problem area, the life span averages about three years. As a result, more frequent replanting is required, increasing production costs.

The change to a less intensive agriculture will reduce farm incomes and the demand for farm labor. With lowered incomes, farm families will spend less for goods and services in the area, and the chronic unemployment problem will be further aggravated.

The high water table hampers the application of on-farm land treatment measures. Subsurface drains will not function and salt reduction cannot be carried out until outlet facilities are available.

Damage to structures also results from the high water table. Wetting and drying of the soil causes it to swell and shrink, leading to the cracking of building foundations. Some homes have been damaged from water seeping into basements, and some septic tanks no longer operate properly.

The high water table also produces conditions conducive to mosquito breeding. Among the species known to breed in this area is the carrier of encephalitis, which has been a serious problem in the San Joaquin Valley in the past. Over 500 cases were reported in 1952; ten percent of these resulted in fatalities and another ten percent required permanent intensive care. 13/ The continued rise of the water table and the expected change from cultivated crops to irrigated pasture will both tend to make the mosquito problem become more severe.

The native vegetation in the area west of River Road grows vigorously during the winter and spring months and dies during the summer. This results in a fire hazard to the adjacent trailer parks.

The project is in an area which has had a high unemployment rate for many years. There is a need for opportunities to reduce this rate. Approximately 15 percent of the problem area is in portions of farms using more than one and one-half man-years per year of hired labor. Another three percent of the problem area is in farms too small to be self-supporting; the remainder is in family farms. There is a need to promote rural development in the area to provide people the opportunity to remain there if they wish.

13/ Figures quoted by representatives of State Department of Public Health at interagency meeting, 1967.

PROJECTS OF OTHER AGENCIES

Two major aqueducts flow southward across the watershed. One, the Delta-Mendota Canal, was constructed as part of the Central Valley Project of the U.S. Bureau of Reclamation. The other, the California Aqueduct, is part of the State Water Project. The Delta-Mendota Canal supplies water to the central part of the watershed. The State Water Project occassionally sells surplus water to users in the watershed.

The problem area receives its water from the Central California Irrigation District, via its Main Canal, which was once known as the Miller and Lux canal. The source of this water is the Mendota Pool, which is at the sourthern end of the Delta-Mendota Canal, about 50 miles south of Newman.

The Westlands Water District serves an area located about 80 miles to the south, using water from the California Aqueduct. The U.S. Bureau of Reclamation is constructing the San Luis Drain to serve this area. The drain will carry subsurface drainage effluent only. This drain flows northward and presently terminates about ten miles south of the Newman Watershed, at a valley storage area known as the Kesterson Reservoir, where its flows are being stored.

At some future date, the San Luis Drain may be extended northward, crossing the watershed. If the drainage effluent from the Newman project is of sufficiently poor quality, the project may be able to discharge into the drain until its full capacity is needed by the Westlands service area. Bureau of Reclamation figures indicate that capacity may be available until about the year 2005. The Bureau has indicated its willingness to allow areas outside of its service area to temporarily use this drain.

The State Department of Water Resources has conducted extensive studies involving the construction of a San Joaquin Master Drain, 14/ serving the entire valley. Such a drain, if ever constructed, would include capacity for subsurface effluent from the Newman project. The water quality management plan being prepared by the Central Valley Regional Water Quality Control Board envisions eventual construction of such a drain.

The State Reclamation Board has powers to restrain any diversion of water that will increase flows in the Sacramento or San Joaquin Rivers or their tributaries. 15/ Any construction of facilities

---

14/ State of California, Department of Water Resources, Bulletin No. 127, San Joaquin Valley Drainage Investigation, San Joaquin Master Drain, Preliminary Edition, January, 1965.

15/ State of California, Water Code, Section 8598.

discharging into these rivers requires a permit from this Board. The Board has also adopted a designated floodway for the unleveed reaches of the San Joaquin River downstream of Hills Ferry Road.

PROJECT FORMULATION

Under the sponsorship of the Orestimba Resource Conservation District, an application for planning assistance under the authority of Public Law 566 for the Newman Watershed Project was approved by the State Resource Conservation Commission in November, 1967, and forwarded to the Secretary of Agriculture. In December, 1970, the Newman Drainage District was formally organized under state law and became a co-sponsor of the project. On the basis of a preliminary investigation report indicating project feasibility, the Administrator of the Soil Conservation Service authorized the project for planning in May, 1971.

Throughout the studies that led to this plan, consultive meetings were held with staffs of various agencies including the Corps of Engineers, Bureau of Reclamation, State Water Resources Control Board, and Central Valley Regional Water Quality Control Board. The project was also discussed with representatives of the Federal Water Quality Administration, the State Department of Water Resources, the State Division of Resource Conservation and the State Reclamation Board. Project Steering Committee and/or Newman Drainage District meetings were held at least bi-monthly during the entire planning process. The Newman Drainage District Directors have met with the Stanislaus County Board of Supervisors, Stanislaus County Regional Planning Agency, and Local Agency Formation Commission. In addition, the Newman Drainage District and the Orestimba Resource Conservation District have held three public hearings that were publicized in the Modesto Bee and local newspapers.

Preliminary drafts of the Watershed Work Plan and Environmental Impact Statement were distributed for informal interagency review in October 1974. Comments were requested from the agencies listed below.

Local Agencies:

Stanislaus County Board of Supervisors
Stanislaus Area Association of Governments
Central California Irrigation District

State Agencies:

Department of Food and Agriculture
Department of Health
Department of Conservation
Department of Fish and Game
Department of Navigation and Ocean Development

State Agencies (cont'd.):

Department of Parks and Recreation (which includes the State Historic Preservation Officer)
Reclamation Board
Department of Water Resources
State Water Resources Control Board
Central Valley Regional Water Quality Control Board

Federal Agencies:

Environmental Protection Agency
Corps of Engineers
Bureau of Outdoor Recreation
Bureau of Reclamation
Fish and Wildlife Service
National Park Service
Farmers Home Administration
Forest Service
Geological Survey
National Marine Fisheries Service
Department of Health, Education and Welfare.

The comments of the various agencies led to some revisions of the reports.

Drafts of the Watershed Work Plan and Environmental Impact Statement were distributed for formal interagency review in May 1975. This review is discussed in detail in the impact statement.

The Newman Watershed is within the San Joaquin Type IV River Basin Study Area. It was also identified as a problem area with an apparently feasible solution in the 1968 Soil and Water Conservation Needs Inventory. 16/

Objectives

The sponsors' objectives to eliminate, as far as practicable, the soil, water and related resources problems within the watershed are as follows:

1. Return the land to its historic cropping pattern, thereby removing the trend towards low-income-producing crops.

2. Reduce the shrink-swell of soils caused by poor drainage conditions, which is leading to problems with home and other building foundations, roads, and other land-surface improvements.

16/ U.S. Soil Conservation Service, Watershed Phase of the 1968 Soil and Water Conservation Needs Inventory, Berkeley, California, August, 1969.

3. Reduce public health problems by draining saturated soils around septic tanks and leach-line fields and by eliminating conditions conducive to mosquito breeding.

4. Improve economic employment opportunities and return the area to a viable rural setting.

All of these objectives are associated with the existing high groundwater conditions and can be met to varying degrees by installing a subsurface drain collector system combined with on-farm land treatment and management measures.

Environmental Considerations

One potential adverse impact of the project is the increase in dissolved salts which the problem area contributes to the San Joaquin River. The Central Valley Regional Water Quality Control Board is developing standards for soluble salt levels which would be considered tolerable in the river. Specific downstream effects will depend on the standards set by the board and will involve flows from an area several orders of magnitude larger than the problem area. Therefore, detailed evaluation of downstream effects was considered beyond the scope of the study and downstream water quality considerations were handled by including an operation cost for meeting water quality standards. Current proposed standards were used for making this estimate.

A second environmental consideration is the temporary disturbance and inconvenience due to construction activities. This includes such items as dust, noise, and traffic. These effects will be minimized by including appropriate requirements in the construction specifications.

Alternative Objectives

One alternative to the proposed project would be to change the land use from its presently deteriorating agriculture to a wetland wildlife preserve. This would involve the public acquisition of about 3,000 acres of land held in 58 parcels, and the relocation of about 50 families. The cost of this would be about $6,000,000. Additional water would have to be introduced as the area is not presently in wetlands. There are existing privately owned wetlands in the region that would be less costly to acquire, less disruptive to society, and more suitable for such development.

A second alternative would be to do nothing. The cropping pattern would continue to change to meet the restrictions imposed by the high water table. Monetary net benefits that would be foregone are estimated to be $142,600 annually. Additional impacts would be a worsening of structural foundation problems, public health problems associated with poor septic tank operation and mosquito breeding

conditions, and economic viability of the area. With lowering farm incomes or total abandonment, the appearance of the area would deteriorate as residents become financially unable or lose the incentive to maintain their properties.

Conservation land treatment measures alone would not solve the problem. Measures to improve land and water management cannot be applied until the water table is lowered. On-farm tile drains will lower the water table, but they must have adequate outlets. Pumps could be used for this purpose, but any such method of lowering the water table will require disposal of the effluent. In view of this, costs for a large number of individual pumping plants and outlet systems were not estimated.

Alternative Structural Solutions

Open drainage mains would require about 55,000 lineal feet of 10-foot deep channels. This would require about 65 acres of land for channels and an additonal area required to dispose of about 400,000 cubic yards of excavated material. Installation cost would be about $100,000 more than the cost of the selected alternative, and operation and maintenance cost would be about $18,000 annually.

A pipeline could be used to convey the drainage effluent to the San Joaquin River. This would avoid the commitment of 11.5 acres of land to an outlet channel. No fish or wildlife habitat would be provided. The installation cost of a pipeline would be about $40,000 more than the cost of the selected alternative.

Alternative Disposal Methods

A reverse osmosis water desalting plant could be used to treat the drainage water. This would reduce the salt concentration in the water entering the river. Disposal of the brine would produce other impacts; their nature would depend on the method of disposal. The installation cost for such a plant would be about $2,750,000. Land costs, site development costs and costs of conveyance facilities are not included in this figure. Annual operation and maintenance would be about $60,000. The cost of disposing of the brine or salt produced by the process was not evaluated.

Drainage disposal by evaporation ponds would require about 1,000 acres of land which is not readily available. Installation cost would be about $7,000,000. Mosquito control would be a continuing problem. Relocations of persons and farm enterprises were not evaluated since a specific location for the ponds was not determined.

Another alternative would be to carry the effluent to the Keterson Reservoir area for temporary storage. This would require

several pumping stations and about 16 miles of pipeline. The effluent would be released to the San Joaquin River at times that would minimize its downstream effects. The power requirement for the pumping stations would be abut 500,000 kilowatt hours per year. Installation costs for the pumps and pipeline would be about $3,000,000, and operation and maintenance would average about $40,000 per year.

Holding ponds could be constructed to provide temporary storage in or near the problem area. This would require about 560 acres of land. The effluent could then be released at times that would minimize adverse impacts downstream. The specific effects would depend on the method of operation. Installation cost would be about $4,000,000. Relocations of persons and farm enterprises would depend on the specific site chosen.

A potential future means of drainage disposal is the construction of a regional collector and disposal system. As more land continues to go under irrigation in the San Joaquin Valley, more and more areas subject to high groundwater problems are becoming evident. It appears likely that a regional solution for the disposal of effluent waters will be a necessity in the future. The Newman project measures are compatible with two proposed regional drains, the San Luis Drain proposed by the Bureau of Reclamation and the Master Drain proposed by the State Department of Water Resources. The Regional Water Quality Board intends to prohibit discharge to the San Joaquin River once a master drain is constructed.

Another alternative would be to postpone construction of the project until master drainage facilities become available. Public health conditions and other problems caused by the high water table would continue to worsen. Monetary net benefits that would be foregone by a ten-year delay are estimated to be about $2,000,000; those foregone by a twenty-year delay are estimated to be about $5,800,000.

Selected Alternative

The installation of a subsurface drainage collection system is the least costly structural alternative considered, both from the standpoint of installation cost and subsequent operation and maintenance cost. It is the least disruptive to individuals, farm operations, and the landscape.

The drainage collection system will allow individual farmers to install on-farm tile drains and lower the water table to a minimum of seven feet below the ground surface. Subsequent land leveling and chiseling, along with irrigation water management and salt reduction, will allow the land to return to the productive capability.

that it had prior to the occurence of the high groundwater problem. Subsurface drains will adequately meet the physical problems of the area as well as the objectives of the sponsors.

WORKS OF IMPROVEMENT TO BE INSTALLED

The sponsors propose to solve the high groundwater problem by applying corrective land treatment and structural measures. The project will include facilities to collect and dispose of excess subsurface water and accumulated salts, and other conservation practices to improve farming operations and help obtain the full potential benefits from the project.

Land Treatment Measures

On-farm subsurface drains to lower the water table will be installed throughout the problem area. Approximately 164,000 feet are expected to be installed during the project installation period. These will permit salt reduction, leaching to reduce harmful concentrations of salts in the soil, to be carried out. Salt reduction will be required on approximately 1,000 acres.

As the water table drops and the cropping pattern changes, other measures to improve land and water management and production efficiency will be applied. Typical measures to improve water management will include irrigation land leveling, surface and subsurface irrigation systems, irrigation water management, about 36,000 feet of irrigation pipelines, about 6,000 feet of irrigation ditch lining, and about 30,000 feet of drainage field ditches. Typical measures to improve and maintain the soil condition include the following:

Chiseling--Loosening the soil without inverting, and with minimum of mixing of the surface soil, to shatter restrictive layers below normal plow depth that inhibit water movement or root development.

Conservation cropping system--Growing crops in combination with needed cultural and management measures.

Crop residue management--Using plant residues to protect cultivated fields during critical erosion periods.

Such measures will also be applied on cropland outside the problem area.

Typical measures to be applied on rangeland include range seeding, proper grazing use, spring development and pond construction. Firebreaks and fences will also be installed where needed.

These measures or other suitable alternatives and combinations will be installed as needed to achieve adequate treatment. The measures will be applied on private land by the individual farmers. The Soil Conservation Service will provide technical assistance to those farmers for planning and applying the measures. The acreages to be adequately treated during the project installation period and the estimated cost of the land treatment program are shown in Table 1.

Structural Measures

To permit the land treatment program in the problem area to be carried out, structural measures will be installed to collect and dispose of the effluent from the on-farm tile drains. The locations of these measures are shown on Figure 1. Detailed plans are included in the Engineering Appendix to this report. Costs are shown in Tables 1 and 2, and other pertinent information is shown in Tables 3 and 3A.

The collection system will consist of about 10.1 miles of open-joint pipe and appurtenant structures such as vents and junction boxes. The system will provide an outlet for each farm unit in the service area. The pipes will be installed with invert depths about nine feet below the ground surface. The use of tile-laying machines will be the preferred method of installation where pipe diameters are small enough for the machines to be used. Pipe sizes are based on a drainage coefficient of 0.0038 cubic feet per second per acre. The collection system includes all lines within the boundaries of the service area.

The disposal system will consist of about 0.4 miles of closed-joint pipe and about 0.9 miles of open channel. The system will convey the drainage effluent from the problem area to the San Joaquin River. The pipeline will carry flows from line A to an existing overflow slough of the river. The open channel, shown as line I on Figure 1, will carry flows from lines B, G, and H across the river's floodplain to its main stream. An eight-foot diameter sump will be installed at the junction of lines B, G, and H, with a gated entrance to the channel. The sump will include provision for a portable pump to be used at times when the river level is above the subsurface drain lines.

A permanent easement thirty feet wide will be acquired for all subsurface lines. An additional seventy feet of width will be acquired for a temporary easement during construction. A total of about 38 acres of permanent easement and 89 acres of temporary easement will be required for these lines. Construction of the subsurface drain lines will also require nine road crossings and eight irrigation canal crossings. One gas line will be crossed, but will not require modification.

Spoil material along the subsurface lines will be placed or spread in a manner that will prevent ponding of surface runoff. Small temporary drain ditches will be provided as needed to carry runoff at non-erosive velocities to existing channels.

An open channel will be constructed to carry the effluent from lines B, G, and H to the San Joaquin River. It will be a new channel, across land that is presently in native dryland pasture. The channel will have a design water depth of about 1.3 feet, but the total depth will average about ten feet, so that the channel bottom will be at the level of the subsurface drains. The top width will average about 36 feet. Other details are shown in Table 3A. A gravel-surfaced maintenance road will be provided along one side of the channel. The channel will require about 11.5 acres of land to be acquired in fee title, and will include one road crossing, a culvert at River Road.

Excavated material will be placed in a spoil bank adjacent to the channel. The spoil bank will average about eight feet in height, with a 15-foot top width and side slopes of about two to one. Drainageways through or around the spoil banks will be provided to convey local runoff to the channel.

The channel will be designed to flow at non-erosive velocities. The channel and spoil bank will also be vegetated to improve their appearance and prevent erosion and rilling of the slopes. About nine acres of grasses and shrubs will be planted.

Contractors will be required to follow applicable guidelines and laws and regulations to minimize soil erosion and water, air and noise pollution during construction. Water or other suppressants will be used as needed to control dust. Runoff from construction sites will be disposed of in a manner that will minimize erosion. Measures such as temporary sediment basins will be used where needed to keep silt from excavations out of the San Joaquin River.

Although there are no presently known archaeological values in the construction area, the Soil Conservation Service will be alert to the possibility of unearthing such values. If evidence of cultural values is discovered during detailed investigations or construction, the Service will contact the District Clearinghouse of the Society for California Archaeology and the National Park Service, and the procedures of PL 93-291 will be followed. Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agencies under Executive Order 11593 with respect to archaeological and historical resources.

No persons, businesses, or farm operations will be displaced by the project.

The total dissolved solids content of the drainage effluent is expected to exceed the permissible level for the San Joaquin River. To meet the water quality standards for the river, higher quality dilution water will be added. Runoff from irrigation in the Eastin Road, Crow Creek, Freitas, Azevedo and Anderson Road drains will be the primary source of dilution water. When additional water is needed, it will be purchased from the Central California Irrigation District and conveyed to the river through existing ditches in the area. The quantity to be purchased is estimated to average 455 acre-feet per year. Should the San Luis Drain or a San Joaquin Master Drain become available, the drainage effluent would no longer enter the San Joaquin River and dilution water would no longer be needed.

EXPLANATION OF INSTALLATION COSTS

Estimated costs to install land treatment measures are summarized in Table 1. These estimates are based on the current costs of similar practices in nearby areas.

The total estimated cost to install the land treatment measures is $3,430,000. Of this total, $3,230,000 is the cost of physically applying these measures, and will be met by the landowners or operators on whose lands the measures are installed. Technical assistance will be provided by the Soil Conservation Service, cooperating with the Orestimba Resource Conservation District. The total estimated cost of technical assistance is $200,000, including $130,000 to be provided from Soil Conservation Service normal operating funds for the going rate of application and $70,000 to be provided from Public Law 566 funds for accelerating the application rate.

Installation costs of the land treatment measures by years during the project installation period are estimated as follows:

Year	PL-566 Funds	Other Funds	Total
1	$ 0	$ 279,000	$ 279,000
2	3,000	301,000	304,000
3	6,000	302,000	308,000
4	8,000	332,000	340,000
5	8,000	338,000	346,000
6	11,000	373,000	384,000
7	11,000	373,000	384,000
8	9,000	368,000	377,000
9	8,000	353,000	361,000
10	6,000	341,000	347,000
TOTAL	$70,000	$3,360,000	$3,430,000

The estimated costs to install structural measures are shown in Tables 1 and 2, and include costs for construction, engineering services, land rights, and project administration.

The construction cost estimates are based on quantities computed as required to provide structures in accordance with the engineering design, and the unit construction costs considered appropriate for the area. The unit costs used were based on recent bid prices for similar types of work under comparable conditions. The cost of irrigation canal crossings is included in the construction cost. The computed costs were increased by a 15 percent contingency factor to obtain the estimated project construction costs.

Engineering costs include costs for surveys, investigations, designs, and preparation of plans and specifications. Engineering costs were estimated at 12 percent of the construction costs.

Land rights costs include costs of acquiring rights-of-way for structural measures, including easements, and the cost of making county road crossings.

Land and easement costs are based on estimated values provided by the Federal Land Bank. Land costs include $1,500 per acre for land purchases and permanent easements outside of the drainage district. Easements within the district will be donated. A value of $200 per acre for these easements was included in the land rights costs.

Surveys, legal fees, and related costs were estimated at $1,000 per parcel outside of the district and $500 per parcel within it. For road crossings, the costs associated with the road itself were included as land rights costs, while the costs of furnishing and placing pipelines across roads were included in the construction costs.

Federal project administration costs include costs for inspection of construction, estimated at 5 percent of the construction cost, and costs for general supervision of project installation at all levels of the Soil Conservation Service, estimated at 5.5 percent of the construction cost. Local project administration costs include costs for administration of contracts, estimated at 1 percent of the construction costs.

Costs which will be borne by Public Law 566 funds are as follows:

1. Fifty percent of the construction costs for all structural measures. This share is estimated to be $249,000.

2. All engineering costs for structural measures. These are estimated to be $60,000.

3. All Soil Conservation Service project administration costs. These are estimated to be $53,000.

Costs which will be borne by other funds are as follows:

1. Fifty percent of the construction costs for all structural measures. This share is estimated to be $249,000.

2. All land rights costs for structural measures. These are estimated to be $71,000.

3. All local project administration costs. These are estimated to be $5,000.

Estimated total expenditures for structural measures by years are tabulated below. These costs are based on the expectation that engineering costs will be incurred during the year of preparation of plans and specifications, and that project administration costs will be incurred during the year of construction.

Year	PL-566 Funds	Other Funds	Total
1	$ 37,000	$ 47,000	$ 84,000
2	150,000	129,000	279,000
3	175,000	149,000	324,000
TOTAL	$ 362,000	$ 325,000	$ 687,000

EFFECTS OF WORKS OF IMPROVEMENT

Conservation Land Treatment

The on-farm subsurface drains will lower the water table to a depth of at least seven feet below the ground surface throughout the 3,030-acre problem area. This will permit the application of additional land treatment practices on the 2,934 acres of cropland and pasture in the area. These practices will minimize soil compaction, promote better soil aeration, and improve water intake into the soil, thus providing a better environment for crop plant roots. Toxic salt reduction will remove accumulated soluble salts from approximately 1,000 acres. The lowered water table will make possible the achievement of a salt balance within the root zone. With the improved root environment, chances for plant diseases will be reduced. Adequate treatment of the entire problem area should be achieved.

The land treatment measures applied on the cropland lying west of State Highway 33 will improve farming operations in this area. In addition, improved land and water management will reduce the amount of subsurface water entering the problem area from higher lands. This will enable the subsurface drains in the problem area to function more effectively.

The trend toward low yields and lower-valued crops in the problem area will be halted and will give way to improved agricultural production, regional income and employment. Expected increases in yields of the principal crops include the following:

Crop	Present Yield (tons per acre)	Expected Yield with Project (tons per acre)
Alfalfa	5.3	8.0
Corn	16.0	19.4
Tomatoes	18.0	25.6
Sugar beets	17.0	26.2
Peas	1.0	2.0

The anticipated effect of the project on cropping patterns in the problem area is as follows:

Crop	Present Acreage	Estimated Acreage in Ten Years Without Project	With Project
Alfalfa	1,257	875	1,600
Corn	89	200	320
Beans, peas	98	65	225
Milo, oats	483	908	150
Irrigated pasture	459	800	50
Sugar beets	178	70	250
Tomatoes	30	0	311
Walnuts	16	16	16
Fallow	324	--	--
Other	96	96	108
TOTAL	3,030	3,030	3,030

Fifty-one landowners on 58 parcels will be directly benefited.

As a result of the lowering of the water table, basement wetness and unstable building foundation problems will be reduced. Septic tanks will be made operative and mosquito breeding areas will be eliminated, reducing the opportunity for incidence and spread of diseases.

The land treatment program will also lead to minor adverse effects on wildlife habitat. The change to more intensive agriculture will lower the quality of pheasant habitat on cropland. Improvements in water management will reduce the amount of irrigation runoff reaching the small Type 9 wetland area in the lower watershed. The subsurface drains will not affect the wetland as its wet condition results from surface runoff.

Application of land treatment practices on rangeland will lead to improved management of this land. Adequate treatment of all rangeland in the watershed during the project installation period is planned.

Structural Measures

The structural measures will provide outlets for the on-farm subsurface drains in the problem area. This will enable the on-farm lines to lower the water table, permitting the application of the remainder of the conservation land treatment program.

The structural measures will carry the drainage effluent to the San Joaquin River. This will increase the quantity of dissolved salts entering the river. The total dissolved solids content of the drainage effluent is expected to be about 1,700 parts per million. The drainage effluent and dilution water will

contribute an estimated 8,000 tons of salt per year to the river. This is on the order of one percent of the present average annual salt quantity carried by the river at a gage near Vernalis, about thirty miles downstream. The project's contribution to the concentration of salts at Vernalis under present conditions will range from a fraction of a percent in the spring and fall to about two percent in the late summer. Under future conditions, the project's contribution to downstream salinity will be negligible, as the annual salt outflow from the San Joaquin Basin is expected to increase to about 2.4 million tons by the year 1990. 16/

The foregoing figures are very approximate. The actual effect of the project will depend on the amount of dilution water actually used, which in turn will depend on the policies adopted by the Regional Water Quality Control Board. The project's potential contribution to degradation of downstream reaches of the river and the Sacramento-San Joaquin Delta will be limited because these policies will consider such effects. Water quality in the Delta is governed by the State Delta Standards, issued in Decision 1379 of the State Water Resources Control Board. This decision is currently being contested in court. Long-term effects of the project will depend on the availability of master drainage facilities.

Conformance to the standards will also minimize the project's impact on fish in the river. The anadromous fish in the river will tolerate salinities considerably in excess of the proposed standards.

Much of the dilution water will enter the river via Orestimba Creek, about five miles downstream of the project outlets. Thus, full dilution will not occur in this five-mile reach of the river. There appear to be no recent records of base salinity levels in this reach, but a review of earlier published data 17, 18/ indicates that the impact of the project will be minimal. There are no known users taking water out of this reach of the river at the present time.

The quality of the drain effluent will improve in the future, as a salt-balance is approached.

16/ State of California, Department of Water Resources, Bulletin No. 127-74, Status of San Joaquin Valley Drainage Problems, December 1974.

17/ U. S. Geological Survey, Quality of Surface Waters of the United States, 1962, Water Supply Paper 1945, Washington, D.C., 1964.

18/ U. S. Geological Survey, Quality of Surface Waters of the United States, 1963, Water Supply Paper 1951, Washington, D.C., 1966.

Carrying out the proposed project measures will permit more effective use of fertilizers and soil amendments within the area and thus reduce fertilizer losses to leaching. Split applications of nitrogen according to crop needs, rotation of shallow and deeprooted crops, and more bountiful harvests should all contribute to increased efficiency in using applied nitrogen, thus tending to decrease nitrogen losses in drainage effluent from the area.

The project will carry the drainage effluent to the river at two defined locations. This will facilitate any future monitoring program that might be undertaken.

The nine acres of grasses and shrubs along the 0.9 mile-long open channel and spoil bank will provide cover and habitat for birds and small game. The continuous flow of the channel will provide an area where catfish and other warm-water fish can live.

The open channel will occupy approximately 11.5 acres of land. This land is presently in native dryland pasture and is used as cattle feed and as a place to hold dry dairy cows. The plantings along the channel will be less susceptible to fires than the native vegetation. The firebreak effect of the channel will reduce the hazard to the adjacent trailer parks.

The project will not affect the habitat of the rare San Joaquin kit fox. The open channel may provide additional habitat for the giant garter snake, also a rare species.

While the project is being installed, environmental values will be temporarily disturbed by equipment noise, movement and stockpiling of earth during drain installation, and other effects of construction on wildlife and on fish in open drains. In addition, approximately 127 acres will be temporarily removed from production.

Economic and Social

The economy of the area will be improved by increased income and the stabilization of employment. The increased income from more intensive land use will make the family farm better able to compete as an employment possibility for labor. The underemployment of human resources will be reduced. An estimated total of 17.5 man-years per year of direct permanent employment will be provided in the agricultural sectors. The multiplier effect will add an estimated 10.5 man-years per year of indirect and induced employment on an annual equivalent basis for the region. The construction phase of the project will provide about 163.5 man-years of direct employment during the installation period. The multiplier effect is expected to add another 257.6 man-years of employment during this period.

Secondary effects of the project include such things as the additional business generated in the food processing industries and the increased business in the commercial enterprises that supply goods and services to the agricultural industry. The change to more intensive agriculture will also generate increases in traffic, waste products, and demands on energy reserves.

The reduction of public health hazards will result in better living conditions on the farms throughout the problem area.

PROJECT BENEFITS

Project benefits are measured as the difference between net farm income attributed to land and management with the drainage project and net farm income attributed to land and management without the project.

Average annual primary benefits are estimated to be $160,000. This includes $10,400 in benefits due to the prevention of future reductions in farm income and $150,200 due to the return to more intensive agriculture.

Secondary benefits stemming from and induced by the project are estimated to be $37,000. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

COMPARISON OF BENEFITS AND COSTS

The average annual primary benefits from the structural works of improvement are estimated to be $160,600. The estimated average annual cost of these measures, including operation and maintenance, is $55,000. This provides a ratio of primary benefits to costs of 2.9 to 1.0. When the estimated local secondary benefits of $37,000 are included, the ratio of benefits to costs is 3.6 to 1.0.

PROJECT INSTALLATION

Structural measures will be installed over a three-year period, generally in accordance with the following schedule:

Year	Preparation of Designs, Plans & Specifications	Acquisition of Land Rights	Construction
1	Open channel, sump, and lines A,A-1, A-2,A-3, B & H.	Open channel and sump.	Open channel and sump.
2	Lines C,D,E,E-1, & F.	Lines A,A-1, A-2,A-3,B & H.	Lines A,A-1, A-2,A-3,B & H.
3	Lines F-1,F-2,G & G-1.	Lines C,D,E, E-1,F,F-1,G & G-1.	Lines C,D,E, E-1,F,F-1,F-2, G, & G-1.

The land treatment program will be carried out over a ten-year period. Land treatment measures in the problem area will generally be installed after the structural measures. Some of the on-farm tile drains will be installed concurrently with the structural measures. As the water table is drawn down, measures for salt reduction can be applied. Other land treatment measures required to achieve project benefits will be applied as the change in cropping pattern occurs. It is estimated that the transition will take ten years.

On-farm land treatment measures will be installed by the individual landowners and operators. The Orestimba Resource Conservation District will provide assistance and encouragement to assure the installation of the measures shown in this work plan. The Soil Conservation Service will continue its going program of technical assistance to the Orestimba Resource Conservation District and will provide the additional technical assistance to accelerate the rate of installation of land treatment measures during the project installation period.

The Newman Drainage District will obtain all the necessary land rights for the project and will arrange for the appraisals needed to acquire these rights. The District will exercise the power of eminent domain if necessary. The District also intends to let and administer construction contracts for all structural measures, but it may, at a later date, request the Soil Conservation Service to administer contracts. The District will meet the requirements for a financial management system set forth in Federal Management Circular 74-7 of the General Services Administration.

The Newman Drainage District will also assure compliance with all appropriate laws and regulations and will obtain all needed permits from the several state agencies concerned with the project. The District will file a report of waste discharge with the Central Valley Regional Water Quality Control Board at least 120 days before the start of construction. The District will also obtain a permit from the State Reclamation Board before constructing any works that discharge into the San Joaquin River.

Before construction is begun, a written agreement assuring that dilution water will be made available at the appropriate time will be obtained. This will be the responsibility of the Newman Drainage District.

The Newman Drainage District has the authority to exercise the power of eminent domain and to construct, operate and maintain facilities both within and outside of the District boundary.

The Soil Conservation Service will provide engineering services for surveys, investigations, designs, and preparation of plans and specifications for structural measures. Inspection of construction of these measures will also be accomplished by the Soil Conservation Service.

FINANCING PROJECT INSTALLATION

The construction cost of land treatment measures will be borne by the individual landowners, with such financial assistance as may be obtained from the credit provided by the regular lending facilities of the USDA's Farmers Home Administration. Technical assistance will be provided by the Soil Conservation Service through its on-going Resource Conservation District program, with accelerated assistance from Public Law 566 funds during the project installation period.

The Newman Drainage District intends to apply for a loan of about $325,000 from the Farmers Home Administration, under the provisions of Public Law 566, and has filed a letter of intent with the Farmers Home Administration. The District will use the loan to meet its share of the installation costs. This will include the costs of purchasing about 11.5 acres of land for the outlet channel and acquiring easements on about 1.6 acres of land outside the District along the lower end of Line A. Easements within the District will be donated.

The District has the authority to levee an ad valorem tax on all ownerships within its boundaries, and will use this authority to obtain the funds required to repay the loan.

The Newman Drainage District will comply with the program income requirements of Federal Management Circular 74-7 of the General Services Administration.

The Soil Conservation Service will contribute Public Law 566 funds for structural measures in accordance with the cost-sharing provisions described in this work plan. The sponsoring local organizations are aware that the financial and other assistance to be provided by the Soil Conservation Service is conditioned on the fulfillment of the local obligations presented in this plan and is contingent on congressional appropriation of the required funds.

PROVISIONS FOR OPERATION AND MAINTENANCE

Operation and maintenance of land treatment measures will be the responsibility of the individual landowners on whose properties the measures are installed. The Orestimba Resource Conservation District, with the assistance of the Soil Conservation Service, will provide the technical advice and periodic inspections necessary to assure that the measures remain effective and are properly maintained.

The Newman Drainage District will be responsible for the maintenance of all structural measures included in this work plan. The District will levy an ad valorem tax to obtain the needed funds. The Newman Drainage District will also be responsible for obtaining a waste discharge permit from the Central Valley Regional Water Quality Control Board and for obtaining the dilution water needed to meet the requirments of the permit. The District will arrange with the Central California Irrigation District for purchase of the dilution water. The Regional Water Quality Control Board will also specify monitoring requirements, and the Newman Drainage District will be responsible for meeting these. The initial monitoring requirements will include discharge, suspended solids, and specific conductance. Frequency of sampling will also be specified.

The estimated average annual operation, maintenance and replacement cost for the structural measures is $6,000. The cost includes $2,300 for the labor, materials, equipment and management needed for maintaining the subsurface drains, $2,000 for maintenance of the open channel, and $1,700 for purchase of dilution water.

An establishment period will be used to allow time for any latent defects or design deficiencies to reveal themselves. The establishment period for each structural measure will extend three years from the date the structure is accepted from the contractor as completed. The establishment period for vegetative work associated with a structural measure will last until one of the following conditions is met:

1. Adequate vegetative cover is obtained.

2. Two growing seasons have elapsed after the initial installation of the vegetative work.

3. The establishment period for the associated structure ends.

After the system is in operation for a number of years, the quality of drainage effluent is expected to improve, as accumulated salts are leached out of the soil. The quantity of drain effluent

is expected to decrease in the future as re-use of water to its fullest extent is realized and irrigation efficiency becomes higher. Both of those factors will mean that less dilution water would be required, resulting in a reduction in this cost.

The dilution water cost shown in this work plan is an estimate based on tentative water quality standards. The Newman Drainage District is fully aware that it will be required to comply with whatever standards are adopted by the Central Valley Regional Water Quality Control Board.

Two to three years after construction is completed, the Soil Conservation Service and the Newman Drainage District, will re-evaluate dilution water needs. This will be done in consultation with the Regional Water Quality Control Board.

Sometime in the future, it will probably become necessary for the project to discharge into either the San Luis Drain or the proposed San Joaquin Master Drain, instead of the San Joaquin River. Should this occur, the Newman Drainage District will be responsible for making the necessary arrangements with the appropriate agency.

Inspection of all completed structural works of improvement will be conducted annually and after any unusual event or condition that might adversely affect a structural measure, to determine the maintenance required. The inspection group will consist of representtatives of the Newman Drainage District, the Orestimba Resource Conservation District, and the Soil Conservation Service, and may include representatives of other interested agencies. These inspections will continue for three years following the installation of each structural measure. Inspections after the third year will be made annually by the sponsors, who will prepare a report and send a copy to the Service.

Specific maintenance agreements will be executed prior to the issuance of invitations to bid for any construction contract. An operation and maintenance plan will be prepared for each structural measure, and the maintenance agreement will refer to the SCS State Operation and Maintenance Handbook. The agreement will also contain provisions for retention and disposal of any real or personal property acquired in whole or part with Public Law 566 funds. These provisions will conform to the requirements of GSA Federal Management Circular 74-7. The Newman Drainage District is fully aware of its responsibilities with regard to maintenance of the project structural measures.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Newman Watershed, California

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/ PL-566 Funds (SCS) 3/	Other Funds	Total Cost
LAND TREATMENT					
Land Areas 2/					
Cropland	Acres	7,400	--	3,020,000	3,020,000
Pastureland	To Be	50	--	10,000	10,000
Rangeland	Treated	3,700	--	200,000	200,000
Technical Assistance			70,000	130,000	200,000
TOTAL LAND TREATMENT			70,000	3,360,000	3,430,000
STRUCTURAL MEASURES					
Construction					
Subsurface Drains	Miles	10.5	228,500	228,500	457,000
Channel Work (0) 4/	Miles	0.9	20,500	20,500	41,000
Subtotal - Construction			249,000	249,000	498,000
Engineering Services			60,000	--	60,000
Project Administration					
Construction Inspection			25,000	--	25,000
Other			28,000	5,000	33,000
Subtotal - Administration			53,000	5,000	58,000
Other Costs					
Land Rights			--	71,000	71,000
Subtotal - Other			--	71,000	71,000
TOTAL STRUCTURAL MEASURES			362,000	325,000	687,000
TOTAL PROJECT			432,000	3,685,000	4,117,000

1/ Price Base, 1974
2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas not just to adequately treated areas.
3/ Federal agency responsible for assisting in installation of works of improvement.
4/ No existing channel.

April 1976

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

NEWMAN WATERSHED, CALIFORNIA

Measures	Unit	Applied to Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Chiseling and Subsoiling	Acres	5,990	40,400
Conservation Cropping System	Acres	7,740	7,800
Crop Residue Managment	Acres	5,940	25,200
Irrigation System, Sprinkler	Acres	2,020	1,010,000
Irrigation System, Surface and Subsurface	Acres	3,030	454,300
Irrigation Water Management	Acres	4,300	8,600
Irrigation Land Leveling	Acres	7,500	600,000
Irrigation Pipeline	Lin.Ft.	12,000	21,600
Irrigation Ditch and Canal Lining	Lin.Ft.	1,010	1,500
Minimum Tillage	Acres	6,370	6,400
Drainage Field Ditch	Lin.Ft.	195,000	164,500
Subsurface Drain	Lin.Ft.	26,400	792,000
Fencing	Lin.Ft.	116,160	232,300
Firebreak	Lin.Ft.	21,400	2,100
Pond	No.	5	10,000
Proper Grazing Use	Acres	3,500	1,800
Range Seeding	Acres	3,220	112,700
Spring Development	No.	5	3,800
TOTAL	--	--	3,495,000

1/ Price base 1974

April 1976

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Newman Watershed, California
1/
(Dollars)

Item	Installation Cost - PL-566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Total Pl-566	Construction	Land Rights	Total Other	
Subsurface Drains	228,500	55,000	283,500	228,500	48,000	276,500	560,000
Channel Work (0)2/	20,500	5,000	25,500	20,500	23,000	43,500	69,000
Subtotal	249,000	60,000	309,000	249,000	71,000 3/	320,000	629,000
Project Administration			53,000			5,000	58,000
GRAND TOTAL			362,000			325,000	687,000

1/ Price base 1974.

2/ No existing channel.

3/ Includes $12,000 for 10 road crossings

April 1976

TABLE 3 - STRUCTURE DATA

SUBSURFACE DRAIN LINES

Newman Watershed, California

Line	Length (feet)	Area Served (acres)	End Design Capacity1/ (cfs)	Diameter 1/ Beginning (inches)	Diameter 1/ End (inches)	Grade 1/ Min. (Ft./Ft.)	Grade 1/ Max. (Ft./Ft.)
Collection System							
A	10,750	865	3.29	8	24	0.0005	0.0024
A-1	1,400	253	0.96	10	12	0.0017	0.0025
A-2	900	50	0.19	8	8	0.0010	0.0010
A-3	750	52	0.20	8	8	0.0010	0.0010
B	12,380	1,175	4.47	8	24	0.0008	0.0019
C	1,900	189	0.72	10	10	0.0021	0.0021
D	3,600	133	0.51	8	8	0.0020	0.0030
E	3,200	187	0.71	8	10	0.0025	0.0030
E-1	420	10	0.04	8	8	0.0020	0.0020
F	5,640	324	1.23	8	12	0.0011	0.0036
F-1	350	34	0.13	8	8	0.0020	0.0020
F-2	300	35	0.13	8	8	0.0020	0.0020
G	4,200	549	2.09	12	14	0.0013	0.0021
G-1	1,050	16	0.06	8	8	0.0015	0.0015
H	6,600	441	1.68	8	18	0.0006	0.0013
Disposal System							
A	1,900	865	3.29	24	24	0.0005	0.0005

1/ Reach-by-reach capacities, diameters and grades can be found in the Engineering Appendix.

April 1976

TABLE 3A - STRUCTURE DATA

CHANNELS

Newman Watershed, California

Channel	Station	Area Served Acres	Drainage Effluent Discharge cfs	Channel Dimensions: Bottom Width ft.	Bottom Grade ft./ft.	Depth of flow ft.	Side Slopes	"n" Value: Aged	"n" Value: As Built	Velocities ft./sec.: Aged	Velocities ft./sec.: As Built	Excavation Cu. Yds.	Type of Work	Type of Existing Channel
Line I	0+00 to 50+00	2,165	8.2	6	0.0005	1.3[1/]	1.5:1	0.040	0.025	0.8	1.1	42,000	I[2/]	0[3/]

1/ Total channel depth averages approximately 10 feet.
2/ Establishment of new channel including necessary stabilization measures.
3/ No existing channel.

April 1976

TABLE 4 - ANNUAL COST

Newman Watershed, California

(Dollars)[1/]

Evaluation Unit	Amortization of Installation Cost[2/]	Operation and Maintenance Cost	Total
Project Structural Measures	45,000	6,000[3/]	51,000
Project Administration	4,000	::::::	4,000
GRAND TOTAL	49,000	6,000	55,000

1/ Price base 1974

2/ 50 years @ 6-7/8 percent interest.

3/ Includes $1,700 for purchase of dilution water.

April 1976

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Newman Watershed, California

NOT APPLICABLE

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Newman Watershed, California

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/			Average Annual Cost 2/	Benefit Cost Ratio
	Drainage	Secondary	Total		
Project Structural Measures	$160,600	37,000	197,600	51,000	3.9:1
Project Administration				4,000	---
GRAND TOTAL	160,600	37,000	197,600	55,000	3.6:1

1/ Price base: Current normalized prices for crops and pasture values, 1974 prices for all others.

2/ From Table 4.

April 1976.

INVESTIGATIONS AND ANALYSES

This watershed work plan incorporates the practical experience of the many people living in the Newman Watershed and the several governmental agencies and local districts that serve the area. Both the Orestimba Resource Conservation District and the Agricultural Extension Service provided much useful information on cropping patterns, yields, production costs, and returns on crops. The experience and technical information provided by the Patterson Field Office of the Soil Conservation Service, the California Department of Water Resources, the Central Valley Regional Water Quality Control Board, and other federal, state and local agencies have all been utilized.

LAND TREATMENT

The land treatment measures in this work plan were developed by technicians of the Soil Conservation Service and were based on technical standards currently being used in the area. Practices installed and being used to date were tablulated. From an analysis of these practices and the conservation needs of the area, a program of land treatment measures was developed to help meet the project objectives. The estimated cost of the land treatment program was then compiled, using field office records and other local sources.

HYDROLOGIC INVESTIGATIONS

Groundwater Studies

Groundwater studies were undertaken to determine the extent of the problem area, the source of the high groundwater, and a drainage coefficient for use in the design of the system.

The extent of the problem area was determined by use of a network of observation wells. Some of the wells have been monitored since 1965, particularly through the irrigation season. The network of wells was expanded periodically during the course of the study, until most wells on the periphery of the network remained dry to a depth of ten feet below the ground. Several additional wells were then drilled and cased to depths of 20 feet along the limits of the high water table area to evaluate groundwater movement into the area and to clarify conditions on the periphery of the area. The boundary of the problem area was then delineated to encompass the land ownerships affected and to include all lands that would make use of the proposed drainage system. Public hearings were held and some people on the periphery of the problem area were excluded at their request from participating in the project.

A number of possible sources of the water causing the problem were investigated. Subsurface flows from the Diablo Range were considered, but these flows are not believed to contribute to the problem because they enter the confined aquifer below the Corcoran Clay member. The possiblity of subsurface flow from the Delta-Mendota Canal and the California Aqueduct was also investigated. It was determined that these canals are not likely to be the direct cause of the high water table for the following reasons:

1. There is no history of any groundwater problem in the area between the Delta-Mendota Canal and the present problem area.

2. The observation wells along the western and southern boundaries of the problem area remained dry to depths of 10 and 20 feet, respectively, during the study period.

3. Maximum amounts of seepage which can be expected from the California Aqueduct or Delta-Mendota Canal are not significant.

It was concluded that the problem is due to the application of irrigation water, generally within the boundaries of the problem area, or immediately west of it. Therefore, the drainage coefficient was computed based on irrigation water requirements within the problem area. Peak and annual consumptive use values for the various crops in the problem area were determined from data in the unpublished Soil Conservation Service Irrigation Guide for the area. These were then weighted for the expected future cropping pattern, and combined to yield composite consumptive use factors for the problem area. Leaching requirements, determined by the procedures set forth in SCS Technical Release 21, were also included.

The field irrigation efficiency within the problem area was estimated to be 60 percent. The remaining 40 percent constitutes the application losses. Surface runoff was estimated to account for about half of this, and the remainder is the portion of the applied water that will be removed by the tile drain system. The computations yielded a drainage coefficient, or peak discharge, of 0.0038 cubic feet per second per acre and an annual discharge volume of approximately 3,400 acre feet from the problem area.

Water Quality

Water quality estimates were obtained for use in determining leaching and dilution water requirements. To do this, water quality

figures were needed for the dilution water, the effluent from the proposed drainage system, and the San Joaquin River. Total dissolved solids content was used as the measure of water quality.

Surface runoff from irrigation is expected to provide adequate dilution during the irrigation season. The sponsors will purchase supplemental water as needed from the Central California Irrigation District. The estimated quantity and quality of the surface runoff was obtained by sampling the Eastin Road, Crow Creek, Freitas, Azevedo, and Anderson Road Drains. The discharges in these drains are not expected to decrease appreciably during the life of the project because irrigation efficiencies are approaching the maximum attainable values. The quality of the supplemental water was estimated to average about 350 parts per million. This figure was furnished by the Central California Irrigation District.

The salinity of the future drainage effluent was estimated to be about 1,700 parts per million. This figure is based on an unpublished study of water use throughout the San Joaquin Valley, made by the California Department of Water Resources.

Future water quality standards for the San Joaquin River were needed for use in estimating dilution water requirements. The Central Valley Regional Water Quality Control Board is developing the water quality control plan for the San Joaquin Basin. This plan does not list specific permissible salinity values for the reach of the San Joaquin River adjacent to Newman. The plan does specify a 30-day average total dissolved solids concentration of 500 milligrams per liter as the water quality objective for the San Joaquin River near Vernalis, where the river enters the Sacramento-San Joaquin Delta. For computation of dilution water costs, the allowable salinity of the diluted effluent was estimated to be 750 parts per million. Comparison with preliminary proposals indicates this figure to be compatible with the water quality control plan.

San Joaquin River Stage

Stage records for the San Joaquin River were reviewed to determine the effect of the river stage on the drainage system outlets. A fifteen-year record ending in 1966 was reviewed and this showed the river stage would occasionally be high enough to restrict the outflow from the system. The high river stages did not occur in the same months that the peak flows from the drainage system are expected. Portable pumps can be used to increase the outflow from the drainage system should the need arise.

GEOLOGIC INVESTIGATIONS

During installation of some on-farm tile drains on the nearby Patterson Watershed, subsurface conditions and construction operations were observed to determine if there were any unusual problems other than the high water table. A number of holes six to ten feet in depth have also been dug in the Newman problem area since 1965. It was concluded that the contractors and equipment available will be able to cope with the problems encountered during construction.

ECONOMIC INVESTIGATIONS

General

The objective of the economic investigations was to establish the nature and extent of the watershed damages and to determine the benefits that would result with the abatement of these damages. Flood water damages in the Newman Watershed were investigated and were found to be negligible. Further economic investigations considered only the high groundwater problem.

Land Use

Present and historical land use data in the problem area were obtained from the Orestimba Resource Conservation District, the Stanislaus County Farm Advisor, and other local agencies, and were verified by field interviews with local farmers. Future land use projections were obtained from farmers in the problem area. These future land use data were compiled for conditions with and without the proposed project. The projections were adjusted to reflect the physical constraints, such as water quality and soil types, that would determine future agricultural land use and cropping pattern. The Stanislaus County Farm Advisor was consulted regarding these adjustments.

Agricultural Damages

The investigation of damages was conducted by personal interviews with local farmers and by empirical analysis. Data on cropping patterns and yields were also obtained from the State Department of Agriculture and the Agricultural Extension Service. The methods used in the investigation of damages are similar to the procedures stated in Chapter 6 of the Economics Guide for Watershed Protection and Flood Prevention.

Agricultural damages were compiled in physical terms and subsequently monetized for benefit evaluation. These damages were analyzed under existing conditions and projected for future conditions with and without the project.

Benefits Attributed to Land Treatment and Structural Measures

The benefits attributed to land treatment measures and to structural measures cannot be readily separated. These works of improvement are not mutually exclusive, but complementary. Therefore, the costs of land treatment measures were handled as production costs or as associated costs, and resulting net benefits are those credited to the structural measures.

The annual net income for the problem area was determined for present conditions and for conditions ten years hence with and without the project. The benefit attributed to prevention of loss of income was then determined by taking the difference between the present annual net income and the annual net income ten years hence without the project, and discounting it for a ten-year lag in accrual, based on a uniform decline and an interest rate of 6-7/8 percent. The benefit attributed to increased income was then determined by taking the difference between the annual net income ten years hence with the project and the present annual net income, and discounting it for the ten-year lag, based on a uniform build-up and an interest rate of 6-7/8 percent.

The land treatment measures and their costs were developed by the Patterson Field Office of the Soil Conservation Service. The information was obtained from field investigations with private concerns and local farmers. Subsurface drains and toxic salt reduction were handled as associated land treatment practices. The average annual cost of these practices was determined by amortizing the capital cost over a period of 50 years at an interest rate of eight percent. The costs of all other land treatment practices were included as production costs in the determination of net farm income.

The average annual primary benefits were then computed by combining the annual benefit attributed to prevention of loss of income with the annual benefit attributed to increased income, and deducting the average annual cost of the associated land treatment practices. Secondary benefits were computed in accordance with Chapter 11 of the Economics Guide. The value of the local secondary benefits stemming from the project was considered to be ten percent of the direct primary benefits. Local secondary benefits induced by the project were considered to be ten percent of the project operation and maintenance costs, plus ten percent of increased production costs. Adjusted normalized prices, as approved by the Water Resources Council, were used for the benefit determination costs.

Employment

Estimates of the effect of the project on employment were based on a procedure for "Estimating Employment Resulting from Project Installation Activities," shown in TSC Technical Note Watersheds PO-5 and PO-5 Supplement 1. The latter specifically outlines the procedure used to estimate employment in the agricultural sector.

Productivity figures for agricultural workers were obtained from input-output models contained in Type I Framework Studies for the California Region. Future gross income figures for the area, with the project and without it, were divided by the gross output per agricultural worker to obtain an estimate of the increase in permanent full-time jobs attributable to the project.

The increase in employment during the construction phase of the project was measured by the profit coefficient of labor.

Type II multipliers were used to estimate the increase in indirect and induced employment resulting from the infusion of additional money into the economic stream of the region.

ENGINEERING INVESTIGATIONS

Surveys

Field surveys were made of the network of observation wells used to define the problem area. Surveys were also made to determine conditions at the outlets of the proposed disposal system. Design of the drainage system was based on U.S. Geological Survey 7-1/2 minute quadrangles and detailed surveys made by the Corps of Engineers.

Design

Reach-by-reach design capacities for the drainage system were determined by summing the discharges from each parcel of land in the service area. For design purposes, the drainage coefficient of 0.0038 cubic feet per second per acre was increased by about 35 percent to a value of 0.0052 cubic feet per second per acre. Gradients were determined from profile drawings, and the pipe sizes were selected to produce full-pipe flow at the higher discharge, using a Manning's "n" of 0.013. A minimum diameter of eight inches was used in the design of the system. The reasons for this are: (1) lines on the peripheral areas will pick up some water from adjacent land as the water table within the problem area drops, (2) eight-inch pipes are easier to maintain than smaller ones and (3) the difference between the cost of eight-inch pipes and the cost of smaller pipes is minimal.

Normal depth computations were made for the open channel which will convey the drainage effluent to the San Joaquin River. Design depth was based on a Manning "n" of 0.040, and velocity was checked with a value of 0.025.

There are several utility companies operating in the problem area. Representatives of these companies were contacted and it was determined that there will be no relocation or modification of existing utilities. One gas line crossing will be required, and this will be accomplished under the supervision of the affected company.

Operation and Maintenance

Estimated operation and maintenance costs for the subsurface drain lines were computed by using a percentage of the construction cost, based on guidelines in SCS Watershed Memorandum Cal-6. Costs for maintenance of the open channel were estimated at $2,000 per mile.

An estimate was made of the annual quantity of dilution water which would have to be purchased. During the spring months, when the discharge in the San Joaquin River is large, the discharge from the drainage system will be small and no dilution water need is anticipated. Higher flows from the drainage system will occur from June through September. This is during the irrigation season, and surface runoff from irrigation is expected to provide adequate dilution. Therefore, the estimated quantity of supplemental water to be purchased was based on the amount needed to dilute the drainage effluent during October, November, and December.

The ratio of dilution water to drainage effluent was computed based on an effluent quality of 1,700 parts per million, a dilution water quality of 350 parts per million, and a desired resultant quality of 750 parts per million. This last figure is equivalent to a specific conductance of about 1,100 micromhos. This led to a ratio of about 2.5 acre-feet of dilution water per acre-foot of drain effluent. Drain discharge was estimated to average about one cubic foot per second during the period from October through December, leading to an annual supplemental dilution water requirement of about 455 acre feet. The cost of purchasing this supplemental water was estimated at $3.75 per acre-foot. This figure was furnished by the Central California Irrigation District.

Cost estimates for a reverse osmosis plant to provide an alternative method of operation were taken from Figures 7-11 and 7-40 of "Desalting Handbook for Planners", published by the Office of Saline Water and the Bureau of Reclamation of the U.S. Department of the Interior.

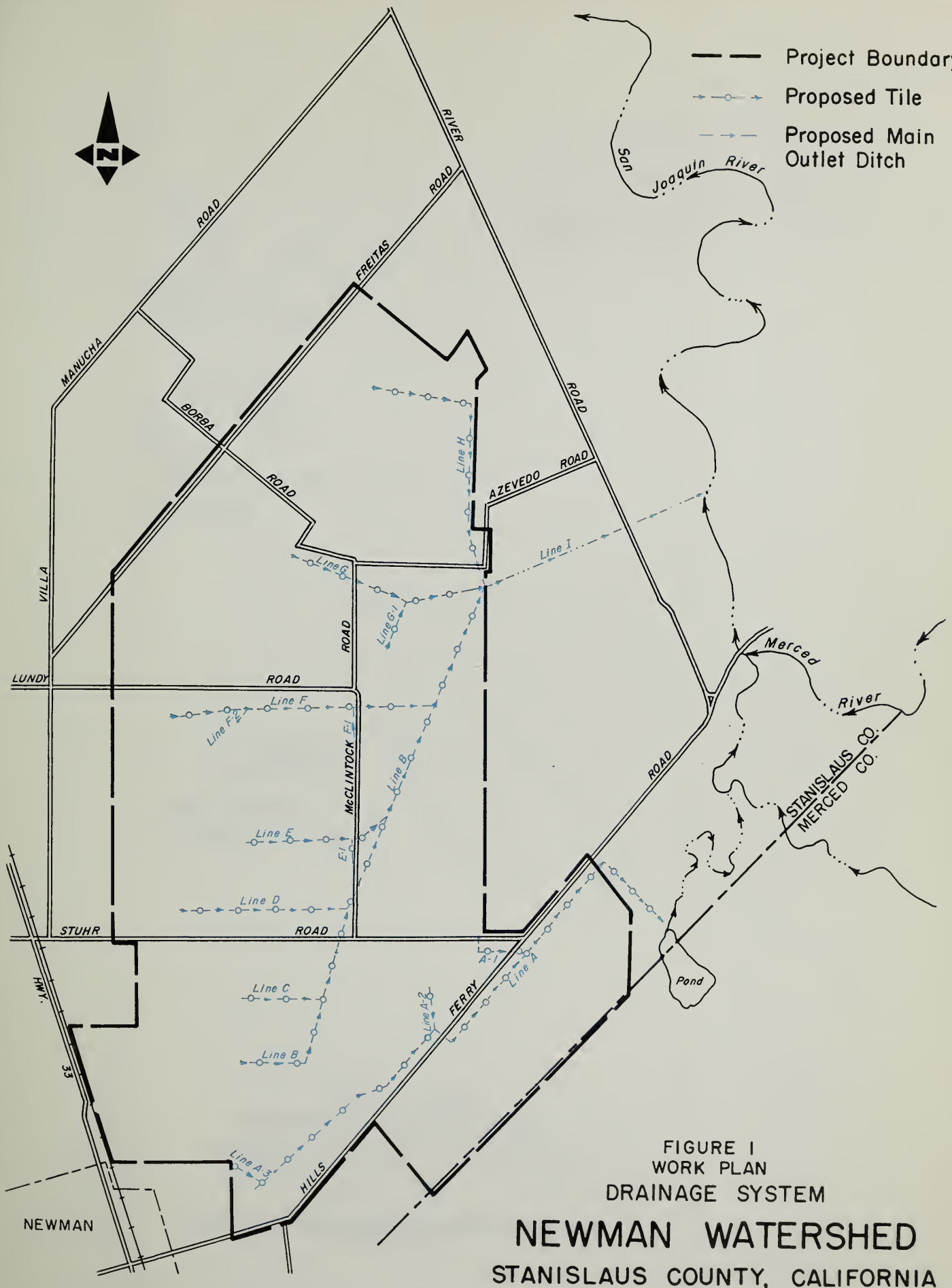

FIGURE 1
WORK PLAN
DRAINAGE SYSTEM

NEWMAN WATERSHED

STANISLAUS COUNTY, CALIFORNIA

APRIL 1976

2000 0 2000 4000 FEET
SCALE 1:36,000

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OR. 1976

PROJECT MAP

NEWMAN WATERSHED

STANISLAUS COUNTY, CALIFORNIA

APRIL 1976

1 0 1 2 3 4 5 MILES

SCALE 1:126,720

M7-N-23325

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE USDA-SCS-PORTLAND, OR. 1976